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GB 2246390 A EP 0202146 A1 EP 0006147 A1  
US 3789382 A

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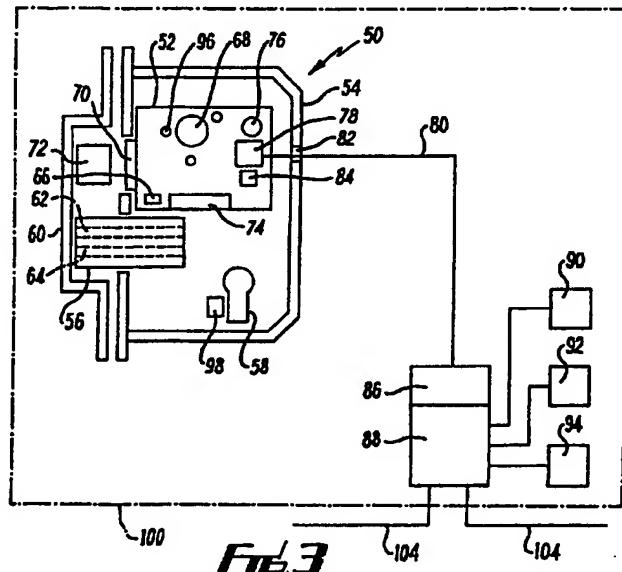
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## (54) SECURITY SYSTEM

(57) A security lock (50) includes a seismic detector 68 and/or a magnetic detector (66) to detect attempted forced entry, and is adapted to report alarm events to a remote monitoring station (106) via a cable network 104 connecting a number of such locks to a shared network driver (102), which is connected to the monitoring station by modem and telephone line. Each protected property is identified by a unique code. An alarm system incorporating a number of such locks may further include intruder and/or smoke detection means and/or a "panic button" (90, 92, 94) which may also send alarm signals to the monitoring station. The lock may also include sensors for detecting opening and closing of the door (70, 72), operation of the lock (74) and the direction of insertion of a key into the lock (98). The lock electronics are mounted on a printed circuit board (52) located within the lock casing (54).



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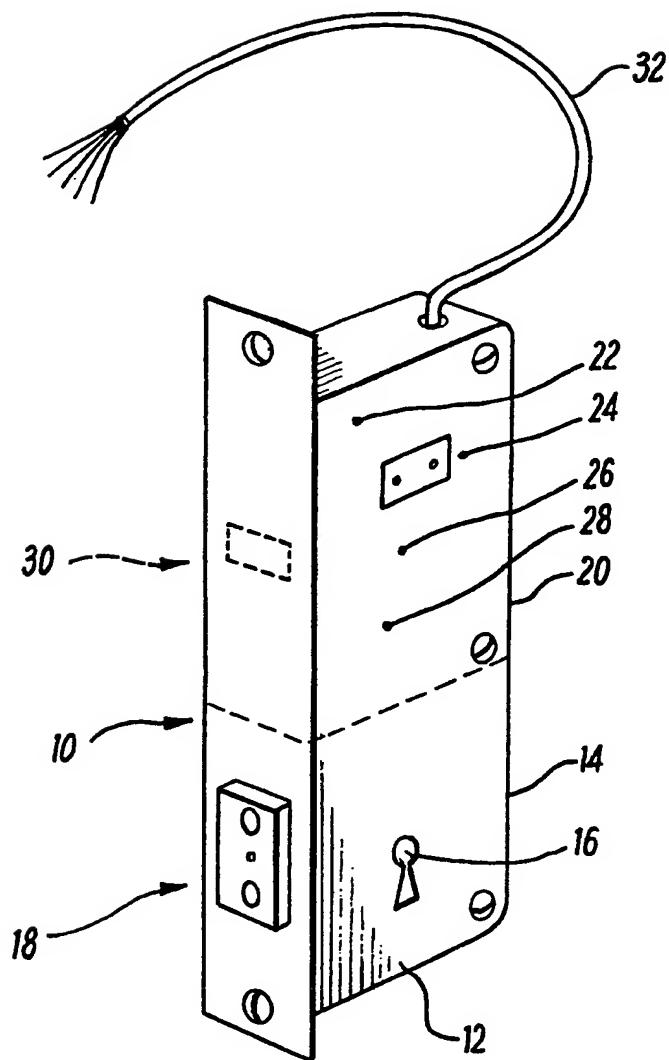
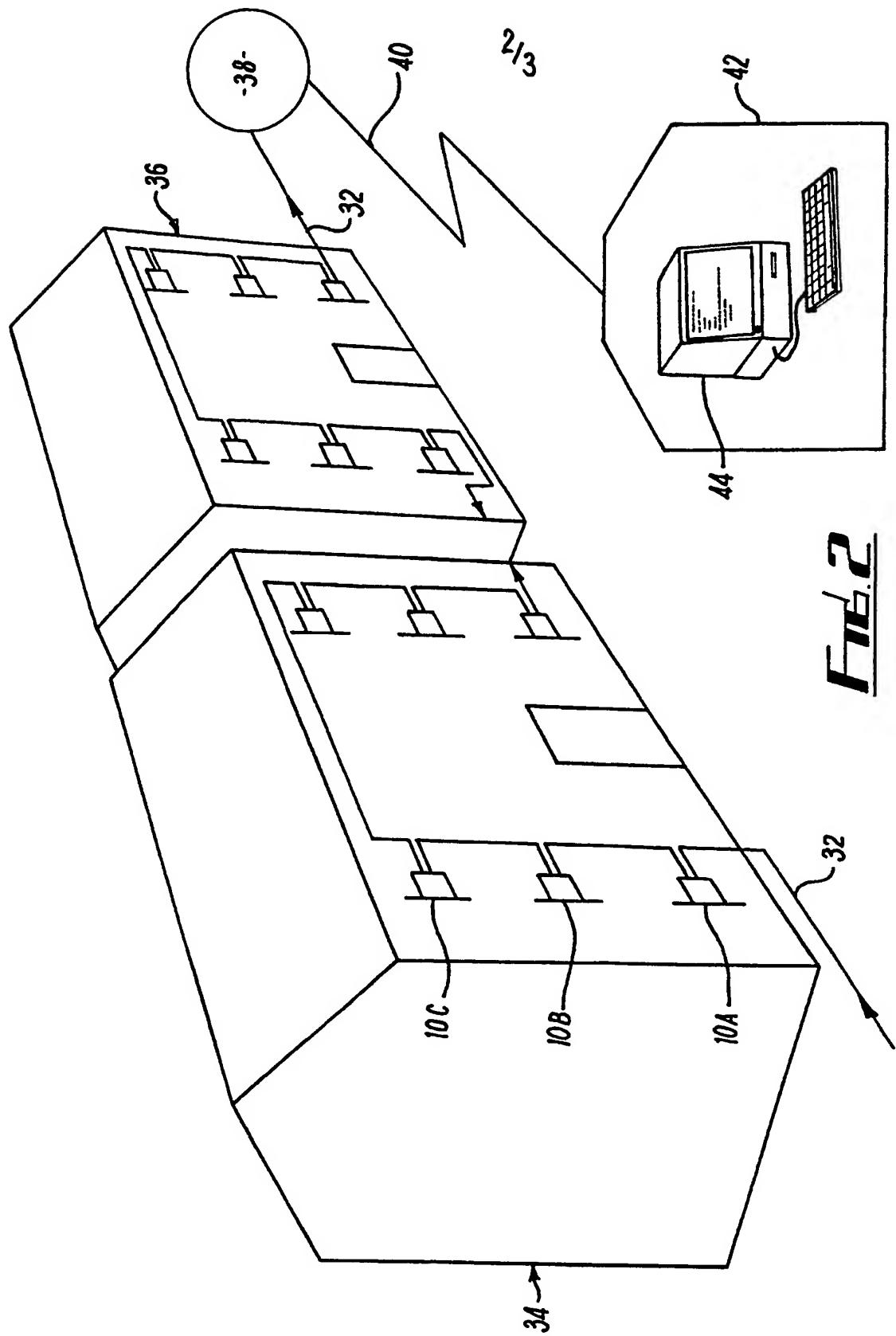


FIG. 1



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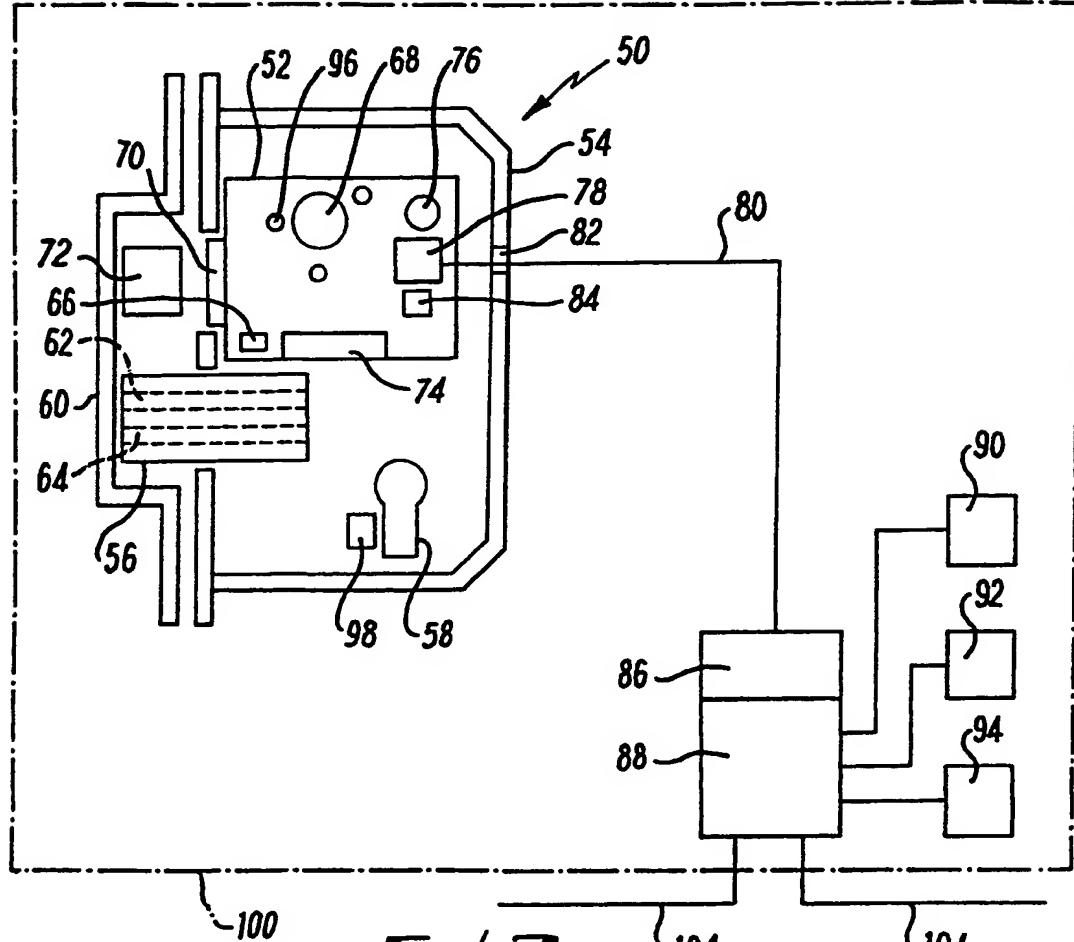


Fig. 3

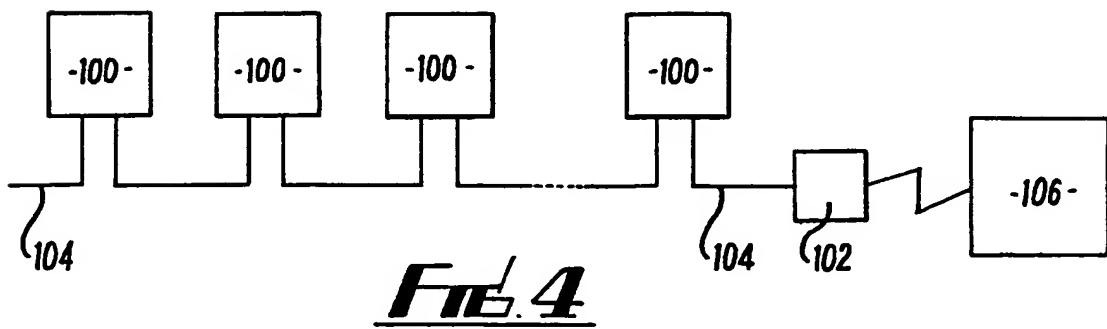


Fig. 4

1       Security System

2

3       This invention relates to a security system, for  
4       example, a security lock on a door connected to a  
5       computer network.

6

7       It is known to provide a security system which sounds a  
8       distant alarm; conventional burglar alarm systems may  
9       sound an alarm at a remote control point at which  
10      several such systems are monitored; ie the systems are  
11      networked. However conventional security locks do not  
12      themselves detect forced entry, only the entry after  
13      the lock has been forced.

14

15      According to the invention a security lock comprises a  
16      locking means; means to detect an unauthorised attack  
17      on the door; and means to connect the lock to a remote  
18      monitoring station.

19

20      The means to detect an unauthorised attack on the door  
21      may be a seismic detector, which will detect gross  
22      vibration of the door, such as occurs when a potential  
23      intruder kicks in the door to force entry.

1      Alternatively, the means to detect an unauthorised  
2      attack on the door may comprise a magnetic detector  
3      associated with the deadlock mechanism of the lock, to  
4      detect forceable opening of the lock, for example by  
5      use of a jemmy.

6

7      Alternatively, both a seismic detector and a magnetic  
8      detector may be provided.

9

10     Optionally the seismic detector and a magnetic  
11     detector, when present, are situated within the casing  
12     of the lock.

13

14     Preferably the means to connect the lock to the remote  
15     monitoring station is situated within the door, eg  
16     between its panels, so that there are no external wires  
17     or other connectors which can be severed to disable the  
18     system.

19

20     Preferably each lock is provided with coding means so  
21     that the individual lock under attack can be identified  
22     at the remote monitoring station. Such a system is  
23     suitable for use on doors in blocks of flats or housing  
24     estates.

25

26     Embodiments of the invention will now be described by  
27     way of example only, with reference to the accompanying  
28     drawings in which:-

29

30         Figure 1 illustrates schematically a door lock  
31         according to the invention;

32

33         Figure 2 illustrates schematically the networking  
34         of a number of door locks according to the  
35         invention;

1       Figure 3 is a schematic sectional view of a  
2       preferred embodiment of a door lock in accordance  
3       with the invention, and associated system  
4       components; and

5

6       Figure 4 is a schematic representation showing the  
7       networking of a number of the locks of Figure 3.

8

9       In Figure 1, a door lock indicated generally by  
10      reference 10 comprises a housing 12 which contains a  
11      conventional mortice lock in its lower part 14,  
12      lockable through a keyhole 16. The deadlock 18 of the  
13      mortice lock is provided with a Hall effect device (not  
14      shown separately).

15

16      Above its lower part 14 is an upper part 20 which  
17      contains within it (but not shown separately) a seismic  
18      detector 22; an internal alarm control 24; an internal  
19      warning buzzer 26; and an internal addressable customer  
20      encoding module 28.

21

22      On the faceplate of the lock above the deadlock is an  
23      in-built door contact 30.

24

25      The housing contains appropriate electrical connections  
26      which pass out of the housing in a cable 32. The  
27      housing is set within a door in the conventional way,  
28      and the cable preferably passes through the door and  
29      doorframe, to avoid exposure of the electrical  
30      connections. The cable 32 is connected to a remote  
31      monitoring station, conveniently passing through ducts  
32      in walls or under floors.

33

34      There may also be provided a smoke detector also  
35      connected through the cable 32 to the monitoring

1 station.

2

3 Figure 2 shows a plurality of door locks 10A, 10B, 10C  
4 etc installed on doors to flats in two blocks of flats  
5 34, 36. Cable 32 is connected through a connector 38  
6 to a telephone or other line 40 and to a remote  
7 monitoring station 42 containing a computer 44.

8

9 In operation, the occupier of a flat locks the mortice  
10 lock when leaving the premises empty. The security  
11 system is then armed.

12

13 If an attempt is made to kick in the door, the seismic  
14 detector 22 senses the gross vibrations of the door,  
15 and sends an alarm signal through the cable 32,  
16 connector 32 and line 40 to the monitoring station 42.  
17 The customer encoding module 28 also sends a signal  
18 identifying the lock under attack to the monitoring  
19 station. It is an advantage of the invention that the  
20 warning can be given silently to the monitoring  
21 station.

22

23 If the lock is attacked with a jemmy, the magnetic  
24 field will be broken, because the Hall effect detector  
25 adjacent to the deadlock 18 is arranged to detect when  
26 the deadlock has been thrown into the keeper;  
27 preferably the arrangement is such that in normal  
28 opening with a key, the deadlock opens a very short  
29 time before the magnetic field is switched off; the  
30 short time may be a few milliseconds; by use of a truth  
31 table, an attack on the door can be distinguished from  
32 a legitimate opening.

33

34 If there is also provided a smoke detector connected  
35 through cable 32 to the monitoring station, warning of

1 fire can be given as well as of an attack on an  
2 identified door.

3

4 When the occupier is at home, it is preferable for  
5 safety reasons, eg rapid escape if there is a fire, not  
6 to lock the mortice lock, but clearly some element of  
7 security is required. This is provided by a small  
8 switch (not shown) on the side of the housing 12 facing  
9 into the flat; there is no keyhole on that side. The  
10 switch can be used to set the seismic detector 22. If  
11 the seismic detector operates, the internal buzzer  
12 sounds; this buzzer also sounds if the smoke alarm  
13 operates, and always sounds when the door opens, as  
14 detected by the contact 30. The occupant is thus  
15 protected and warned of an intruder when at home.

16

17 In addition, the internal alarm control 24 can be used  
18 as a panic button; if the occupier presses an  
19 associated button (not shown), an emergency help call  
20 is registered at the remote monitoring station 42, with  
21 the code identifying the lock, and therefore the  
22 address, from which the help call originated.

23

24 Preferably the computer 44 in monitoring station 42  
25 operates in a polling mode, checking the integrity of  
26 all the locks connected to it. For example, 256 locks  
27 may be connected, each with an individual identifying  
28 code set on the customer encoding modules 28.

29

30 Figure 3 illustrates a preferred embodiment of the  
31 invention. The alarm control electronics and sensors of  
32 the lock 50 are all mounted on a double-sided printed  
33 circuit board (PCB) 52, designed to be enclosed within  
34 the upper half of the lock casing 54, above the  
35 conventional lock mechanism (not illustrated in

1 detail), which includes a deadbolt 56 and a keyhole 58.  
2 The deadbolt 56 engages a lock keeper 60 mounted on the  
3 door jamb, and has incorporated therein upper and lower  
4 hardened, anti-saw rollers 62, 64.

5

6 In this embodiment, the magnetic sensor to detect the  
7 use of a jemmy comprises a Hall-effect Schmitt-trigger  
8 device 66 located at the lower edge of the PCB adjacent  
9 the upper surface of the deadbolt 56. The lowermost  
10 roller 64 is magnetised, so that the use of a ferrous  
11 implement to force the lock will cause the magnetic  
12 field of the lowermost roller 64 to be coupled into the  
13 upper roller 62. This change is detected by the Hall  
14 effect sensor 66 to generate an alarm signal. The  
15 seismic detector in this case is a piezoelectric device  
16 68 mounted on the PCB 52.

17

18 Opening and closing of the door is detected by a reed  
19 switch 70 mounted on an edge of the PCB 52 facing a  
20 magnet 72 located in the lock keeper 60 in a space  
21 above the deadbolt 56. This arrangement obviates the  
22 need for separate cabling to the door jamb. Operation  
23 of the lock 50 is detected by a switch 74, located  
24 beside the Hall effect sensor 66 on the lower edge of  
25 the PCB 52, which operates in response to movement of  
26 the deadbolt 56. An integral piezoelectric sounder 76  
27 is also mounted on the PCB 52, and a connector block 78  
28 allows connection to the external system, suitably via  
29 a six-conductor ribbon cable 80 which exits the casing  
30 54 via a slot 82. The cable 80 may be connected to the  
31 rest of the system via a "contact hinge" fitted to the  
32 door, as an additional anti-tamper measure. The PCB 52  
33 also includes a micro-switch 84 for setting up the  
34 alarm system.

35

1 The reverse side of the PCB 52 (not shown) carries  
2 conductors connecting the above mentioned components  
3 together with additional discrete surface-mount  
4 components and integrated circuits (not shown),  
5 including a Programmable Integrated Circuit (PIC)  
6 providing control logic for operation of the alarm  
7 system, including anti-false-alarm and can't-set  
8 functions.

9  
10 The casing 50 of the lock typically includes hardened  
11 steel anti-drill plates, which protect the electronics  
12 as well as the mechanical lock mechanism itself.

13  
14 The cable 80 is connected to a tenant-identification  
15 module (TIM) 86 located within the dwelling, which has  
16 a unique network address (suitably an eight-digit  
17 binary number set by a DIP-switch within the TIM 86).  
18 In this example, the TIM 86 forms part of a power  
19 supply unit (PSU) 88, suitably providing a 12V dc  
20 supply and including a sealed lead acid back-up  
21 battery. The PSU is powered from the dwelling's own  
22 power supply, but PSU's on the network can be  
23 interlinked so as to maintain power in each dwelling  
24 even if the power supply is turned off for extended  
25 periods (eg. if the dwelling is vacant). In a variation  
26 of the system, a number of individual dwellings could  
27 have their own TIM's connected to a shared PSU.

28  
29 Each dwelling may also be provided with other sensors  
30 such as a smoke detector 90 and a passive infra-red  
31 detector (PIR) 92, together with a "panic" switch 94,  
32 which are all connected to the network via the TIM/PSU  
33 86/88 and may be set simply by operation of the lock  
34 50.

35

1 The seismic detector 68 is preferably of the multi-  
2 count, programmable type. The output signal from the  
3 seismic detector may be processed by the control logic  
4 to minimise false alarms. The set-up switch 84 is  
5 accessible through an opening (not shown) in the casing  
6 54 and allows the lock to be switched to a set up mode  
7 in which the sensitivity of the detector 68 may be  
8 adjusted by means of a variable resistor 96, which is  
9 also accessible via a further opening (not shown). The  
10 sounder 76 may be employed in the set up mode to assist  
11 in setting the sensitivity by providing different audio  
12 signals (including different numbers of "pips" and  
13 different signal frequencies), in response to different  
14 levels and types of vibration (eg. multiple knocks  
15 within a particular period). In its normal operational  
16 mode, the system can also be adapted to produce  
17 different alarm conditions in response to different  
18 vibrations.

19

20 The set-up switch 84 might also be used to set further  
21 modes of operation, such as an "unoccupied" mode for  
22 use where a dwelling is vacant for an extended period  
23 of time. In this mode, the system may report every time  
24 the door is opened and closed, providing a log of  
25 access to the property.

26

27 The system electronics may also include an event log to  
28 record alarm events, which may yield useful information  
29 if there were multiple attempted break-ins at different  
30 dwellings on the network.

31

32 As noted in relation to the first embodiment, it is  
33 desirable that the system be set in differing modes  
34 depending upon whether the dwelling is occupied or not.  
35 In the first embodiment the lock has no keyhole on its

1      inner side, and the system is set in "occupied" mode by  
2      operation of a separate switch within the dwelling. In  
3      many cases, however, it will be desirable that the lock  
4      can be operated from inside the dwelling. In this case,  
5      different modes can be set by operation of the lock by  
6      detecting the direction from which the key is inserted  
7      in the keyhole. For this purpose, a suitable sensor 98  
8      may be incorporated into the lock 50 to detect the  
9      direction of insertion of the key. This might be an  
10     optical or infra red transmitter and receiver, or other  
11     suitable sensor as will be apparent to those skilled in  
12     the art. If the lock is operated from outside, the  
13     system would typically be fully armed; if locked from  
14     the inside, only certain sensors and functions would be  
15     enabled.

16

17     The ability to detect the direction of entry of the key  
18     also provides the basis for detecting attempts to pick  
19     the lock; the system may be adapted to generate an  
20     alarm if an implement is inserted into the lock from  
21     "outside" and remains in the lock for a time greater  
22     than a predetermined period (eg 20 seconds).

23

24     The "panic" switch 94 can be used to send an alarm  
25     signal over the network regardless of whether the alarm  
26     system is enabled. The smoke detector 92 can be powered  
27     by the PSU 88, avoiding the problem of an internal  
28     battery failing or being removed.

29

30     Figure 4 illustrates the networking of a number of  
31     properties. The blocks 100 correspond to the apparatus  
32     located at each dwelling, as indicated by the dashed  
33     line in Figure 3. The individual units 100 are  
34     connected to each other and to a network driver 102 by  
35     means of a "data highway" 104. A 3-core data highway is

1 sufficient for the necessary power and data  
2 connections, but a standard 6-core cable is preferred  
3 to provide complete redundancy for all of the power and  
4 data circuits. The network driver is connected to the  
5 monitoring station 106 by a modem and standard PSTN  
6 telephone line.

7

8 The network driver 102 is the intelligent interface  
9 which collects information from each unit 100 on the  
10 circuit, and may be adapted from an industry standard  
11 data collector. It may be either analogue or digitally  
12 addressable. It acts as a dumb terminal and in this  
13 application need have no operator controls. However,  
14 local set-up commands can be carried out via an  
15 engineering keypad, or remotely from the monitoring  
16 station 106. Typically, the network driver might  
17 support up to 50 units 100 with four channels per TIM  
18 86, and up to 2000m of data highway 104. It is not  
19 necessary to use screened cable. Typically, the network  
20 driver may be capable of logging up to 300 events with  
21 times and dates, and may include a serial input/output  
22 port for connection of a local printer.

23

24 The network driver communicates with the monitoring  
25 station 106 in the event of an alarm. The monitoring  
26 station 106 may be a personal computer equipped with  
27 modems. The monitoring station 106 may also download  
28 commands to the network driver 102, for example to  
29 operate relays at remote sites controlling lights,  
30 sounders, cameras or the like which might also be  
31 connected to the system. The network driver 102 can  
32 also report faults or damage in the network cabling to  
33 the monitoring station 106.

34

35 The system is arranged such that the alarms are set

1 simply by the operation of the lock when the tenant  
2 leaves the protected property. When the key is turned,  
3 the sounder 76 preferably operates for a period  
4 (suitably 10 seconds) prior to connecting to the  
5 network, whereafter the property is protected. If an  
6 alarm signal is detected during this period (eg from  
7 air turbulence affecting the PIR unit 90) then the  
8 sounder will switch to an intermittent tone (indicating  
9 "can't set") and the setting procedure is aborted.

10  
11 Opening and relocking the door will initiate a second  
12 attempt to set the system and access the network. If  
13 repeated attempts to set the system fail, the sounder  
14 will sound for a longer period (eg 30 seconds) to  
15 indicate that there is a fault and that the system is  
16 not operational.

17  
18 When the system is set from inside the property  
19 (whether by operation of a separate switch or by  
20 operation of the lock from inside), the sensors on the  
21 lock will be activated together with certain other  
22 system sensors; eg selected PIR units if there are  
23 multiple units in the property. In this case, certain  
24 alarm conditions may result only in the local sounder  
25 being activated, with no network alarm signal. This  
26 will minimise false alarms. Operation of the panic  
27 switch 94 or smoke detector will always result in a  
28 network alarm.

29  
30 The lock might further include a microphone (not  
31 shown), which would allow activity within the property  
32 to be monitored in the event of an alarm. The  
33 microphone output would only be accessible when the  
34 lock had been operated from the outside.

35

1 It is a great advantage of a security system according  
2 to the invention that security can be provided  
3 economically to a large number of adjacent domestic  
4 dwellings. It is an advantage of a security lock  
5 according to the invention that the security system is  
6 not easily accessed, even when a door has been broken  
7 down. further, an alarm is given before the door is  
8 opened by an intruder.

9

1      Claims

2

3      1. A security lock comprising a locking means; means  
4      to detect an unauthorised attack on the door; and means  
5      to connect the lock to a remote monitoring station.

6

7      2. A security lock as claimed in Claim 1, wherein the  
8      means to detect an unauthorised attack on the door  
9      comprises a seismic detector.

10

11     3. A security lock as claimed in Claim 2, wherein  
12     said seismic detector is adapted for detecting gross  
13     vibration of the door.

14

15     4. A security lock as claimed in Claim 2 or Claim 3,  
16     wherein said seismic detector comprises a piezoelectric  
17     device.

18

19     5. A security lock as claimed in any preceding Claim  
20     1, wherein the means to detect an unauthorised attack  
21     on the door includes a magnetic detector associated  
22     with the deadlock mechanism of the lock, to detect  
23     forceable opening of the lock, such as by use of a  
24     jemmy.

25

26     6. A security lock as claimed in Claim 5, wherein  
27     said magnetic detector comprises a Hall effect device.

28

29     7. A security lock as claimed in Claim 6, wherein the  
30     locking means includes a deadbolt having upper and  
31     lower hardened rollers, one of said rollers being  
32     magnetised, and said Hall effect device being located  
33     adjacent the non-magnetised roller.

34

35     8. A security lock as claimed in any preceding Claim,

1       further including means for detecting the opening and  
2       closing of a door in which the lock is mounted, in use.  
3

4       9. A security lock as claimed in Claim 8, wherein  
5       said means for detecting the opening and closing of the  
6       door comprises a reed switch mounted to operate in  
7       response to the proximity of a magnet located in a  
8       keeper portion of the lock mounted on the door jamb, in  
9       use.

10

11      10. A security lock as claimed in any preceding Claim,  
12       further including means to detect operation of the  
13       lock.

14

15      11. A security lock as claimed in Claim 10, wherein  
16       said means to detect operation of the lock comprises a  
17       switch located adjacent a deadbolt forming part of the  
18       locking means.

19

20      12. A security lock as claimed in any preceding Claim,  
21       wherein the means to detect an unauthorised attack on  
22       the door, and other detection means where fitted, are  
23       situated within the casing of the lock.

24

25      13. A security lock as claimed in Claim 12, wherein  
26       said means to detect an unauthorised attack on the  
27       door, and said other detection means where fitted, are  
28       mounted on a printed circuit board located in an upper  
29       portion of said casing above the locking means.

30

31      14. A security lock as claimed in any preceding Claim,  
32       further including means to detect the direction in  
33       which a key is inserted into the lock.

34

35      15. A security lock as claimed in Claim 12, wherein

1       said means to detect the direction of insertion of the  
2       key comprises a sensor located adjacent the keyhole of  
3       the lock.

4

5       16. A security lock as claimed in any preceding Claim,  
6       further including an audio sounder device.

7

8       17. A security lock as claimed in any preceding Claim,  
9       wherein the means to connect the lock to the remote  
10      monitoring station is situated within the door so that  
11      there are no external wires or other connectors which  
12      can be severed to disable the system.

13

14      18. A security lock as claimed in any preceding Claim,  
15      wherein each lock is provided with associated coding  
16      means so that the individual lock under attack can be  
17      identified at the remote monitoring station.

18

19      19. A security lock as claimed in Claim 18, wherein  
20      said coding means is located in a unit separate from  
21      the lock, within the property to be protected by the  
22      lock.

23

24      20. An alarm system incorporating at least one  
25      security lock as claimed in any preceding Claim, in  
26      which each lock is connected, via coding means  
27      identifying each individual lock, to a remote  
28      monitoring centre.

29

30      21. An alarm system as claimed in Claim 20, wherein a  
31      number of locks are connected to a shared network  
32      driver unit, and said network driver unit is connected  
33      to said monitoring station.

34

35      22. An alarm system as claimed in Claim 20 or Claim

1       21, where in each lock has an associated power supply  
2       unit.

3

4       23. An alarm system as claimed in Claim 20, Claim 21  
5       or Claim 22, wherein each protected property is further  
6       provided with intruder detector means, and/or smoke  
7       detector means and/or an emergency call button,  
8       connected to said monitoring station.

9

10      24. An alarm system as claimed in Claim 23, in which  
11       the system can be set in different modes of operation  
12       depending upon whether or not individual protected  
13       properties are occupied.

14

15      25. A security lock substantially as hereinbefore  
16       described with reference to the accompanying drawings.

17

18      26. An alarm system substantially as hereinbefore  
19       described with reference to the accompanying drawings.

20

## Relevant Technical Fields

(i) UK Cl (Ed.N) E2A (AAA, -B, -D, -E, -F, -G)

(ii) Int Cl (Ed.6) E05B 45/00; G08B 13/06, 13/16

Search Examiner  
A ANGELEDate of completion of Search  
3 MAY 1995

## Databases (see below)

(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii)

Documents considered relevant following a search in respect of Claims :-  
ALL

## Categories of documents

X: Document indicating lack of novelty or of inventive step.

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Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

A: Document indicating technological background and/or state of the art.

&amp;: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
X	GB 2246390 A	(SUNAMI)	1, 10, 12 14, 15, 17 at least
X	EP 0202146 A1	(FERCO)	1 to 3 at least
X	EP 0006147 A1	(HEILAND)	1 to 4, 11 to 13 at least
X	US 3789382 A	(WARREN) see whole document in each case	1, 5, 10 to 12, 19 20 at least

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